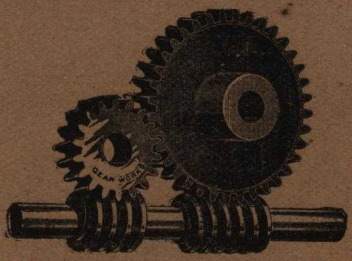
George B. Grant,
Proprietor.

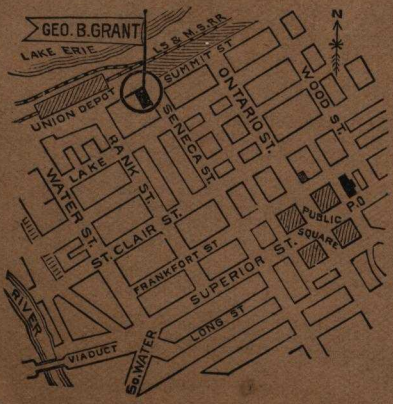
Wm. R. Sawyer,
Superintendent.



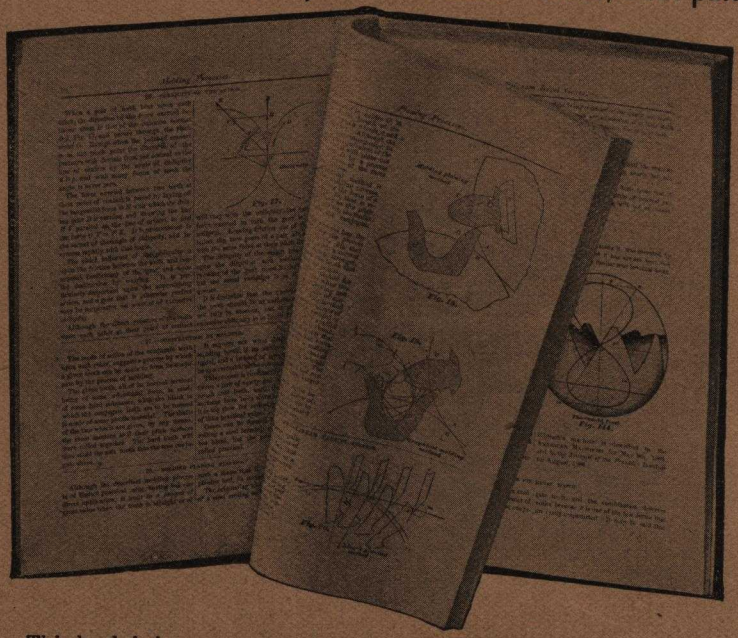
CLEVELAND GEAR WORKS,

86 SENECA STREET,

CLEVELAND, OHIO.



TREATISE ON GEARS, by Geo. B. Grant. $1.00, Post-paid.

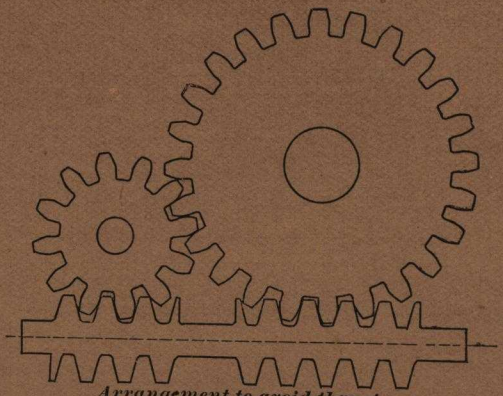


This book is in no way an advertisement of our business, but a regular treatise on the whole subject of gear wheels and the teeth of gears.

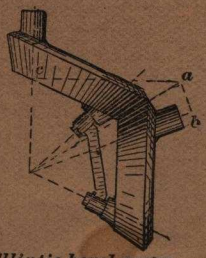
It is largely used as a reference and text book by classes in drafting and technical schools, and is in use as a common working tool by draftsmen, pattern makers machinists, and amateurs all over the country.

We are so sure that this book will please any one in our line of business that we refund the price paid if the book is promptly returned to us. It will thus cost six cents, for postage, to examine it.

We want agents on liberal terms and many a man can make money selling a dozen or two to fellow workmen.



Arrangement to avoid thrust
Fig. 95.



Elliptic bevel gears
Fig. 141.

..1898..

ALWAYS ADDRESS

Cleveland Gear Works,

86 SENECA ST.,

Cleveland, = Ohio.

GEO. B. GRANT, Propr.

WM. R. SAWYER, Supt.

Gear Wheels and Gear Cutting.

Gearing of every Description
In Stock or Made to Order.

ESTIMATES OF COST FURNISHED
ON RECEIPT OF FULL PARTICULARS.

TELEPHONE CONNECTION.

BUSINESS NOTES.

Estimates of cost will be made promptly on receipt of full information, and a drawing or a good sketch is generally necessary. No change from the original description can be made. The estimate must be mentioned when the order is given, and within one month of its date.

As a rule nothing is saved by getting an estimate. A low price means a cheap piece of work, here or elsewhere.

List Prices. The list price is a humbug unless firmly adhered to, and list prices on iron gears are not adhered to. It takes no longer to write for a net price than for the discount on the list price.

Credit is determined by Bradstreet's Mercantile Reports. If the report is good we charge at thirty days and draw to settle an overdue account. If there is no report, or if it is not good, we cannot trust, but must ask for a deposit to secure payment.

Loans. If a stranger should call at your office and request a loan for a month he would not be very likely to get it. If you order our goods, and your name is not in Bradstreet's, you are a stranger to us. A ledger account is a loan for a month.

Drafts. Don't get mad because we draw on you. Some concerns like to pay by draft and others do not. We do not know whether you do or not.

Freight. If you are patient and like to sit down and wait for things to turn up, just order a small package sent by freight.

Freight is slow, sometimes beyond reason. Delivery is complete when goods are on board cars, and we will not be responsible for delay and damage thereafter. We charge 25 cents teaming for packages of less than 100 lbs. ordered sent by freight.

Express or Registered Mail packages are at our risk until delivered to customer. Goods wanted in haste must go by express or mail.

Catalogue must be the latest. Old ones are void.

Competition. We sell our list gears and make prices generally in competition with any concerns who furnish goods of the same kind and quality, and when we do not do it, we want to know it with full details.

Cost of a special gear is much more than that of a similar list gear.

List Gears. A list gear is cheap because it is made by a cheap process. Where a hundred gears are made, each one costs much less than if made alone.

Cast Teeth are cheaper only for gears in considerable quantity, unless they are list gears, for special patterns must be made for special gears.

Delay. The principal cause of delay is the time taken to get an estimate, and one of the greatest causes is the practice of giving orders without sketches or competent directions. We never touch a piece of work until we have reason to believe that we understand what is wanted, and if you are in a hurry, you will save time by laying out your work with great care.

Please Don't. Don't ask a price on one gear and say you are going to have a thousand later on. It is harmless, but it makes us tired.

MECHANICAL NOTES.

Unless otherwise described every gear ordered is a cut spur gear of cast iron, and it will have such diameter, pitch, face, hole, hub, and quality, as we happen to think most desirable. Describe what you want and that you will get, but if you omit any detail we may write to you for the information required or we may guess at it and go ahead.

A Fit is guaranteed only when we have the parts to be fitted. We ream a hole with a one-inch reamer, for example, but do not guarantee that it will fit your one-inch shaft.

Steel Castings are generally full of blow holes, and it takes a long time to get them. A cast iron gear of wider face is as strong and cheaper.

Noise at a high speed is unavoidable. Fibre gears are quieter and softer than metal, and raw-hide is still quieter and less durable. Raw-hide and fibre are good at high speed, but unsuitable for heavy strains.

CLEVELAND LIBRARY

Key Ways and Set Screws are never furnished unless ordered.

Repeat your requirements with every order, for we cannot be expected to remember small details of former orders.

Blanks sent to us to be cut are assumed to be of the proper shape, and we cannot be responsible for any trouble due to wrong sizes.

How to Turn Gear Blanks.—**Don't do it unless you know how.** For $1.00 we will send you a Treatise on Gears, postpaid, with full and practical working directions.

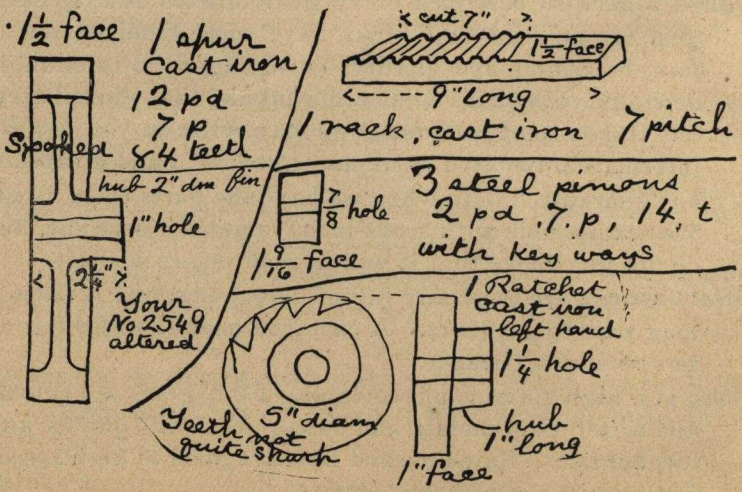
Diameter, as used in this business, is always the pitch diameter.

Teeth of spur gears are always as shown by the sixth and seventh pages, and teeth of bevel gears are described on the back cover page.

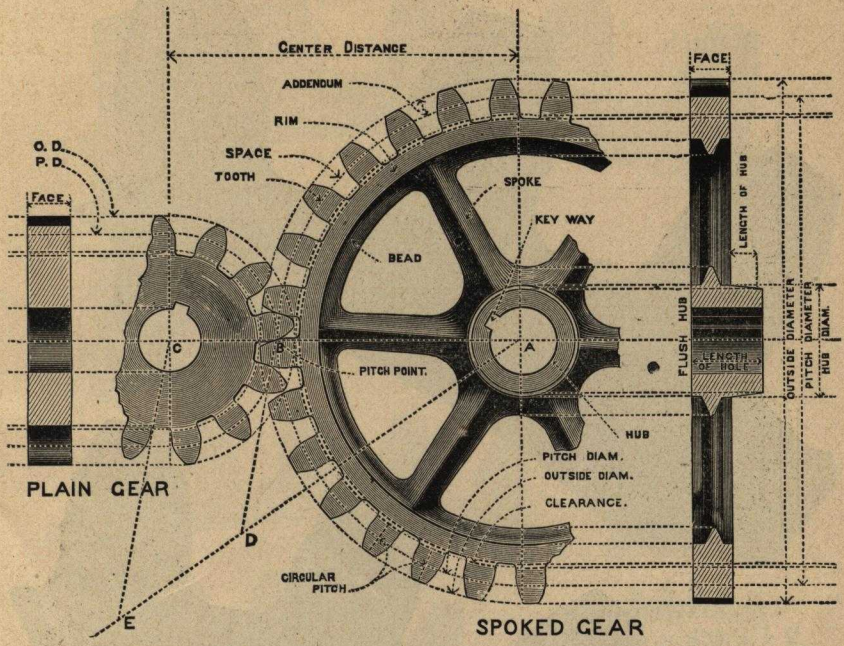
Center Distances. The distance between shafts, center to center, should always be stated, to insure a fit.

Racks are always liable to be bent by the process of cutting the teeth, as the metal is removed from one side of the bar.

We are not responsible for any mistake, even if we make it ourselves, if it could have been prevented by sending us working drawings or good sketches. If you make us guess, you must take the responsibility. A poor drawing is better than none.



A POOR DRAWING IS BETTER THAN NONE.



DRAWING THE SPUR GEAR WHEEL.

The cut shows a pair of common spur gears and names the principal parts.

Spur gears are gears on parallel axes. Internal gears and racks and some forms of spiral gears are spur gears.

Theoretically the teeth of spur gears may be of any desired size, but, as they must be shaped by expensive cutters of fixed forms, they are practically confined to certain definite shapes and sizes known as "standard" forms and pitches.

The best form of tooth, and the only tooth that we furnish, is the involute tooth.

On pages 6 and 7 are shown the actual standard sizes of the teeth as printed by cut gear teeth.

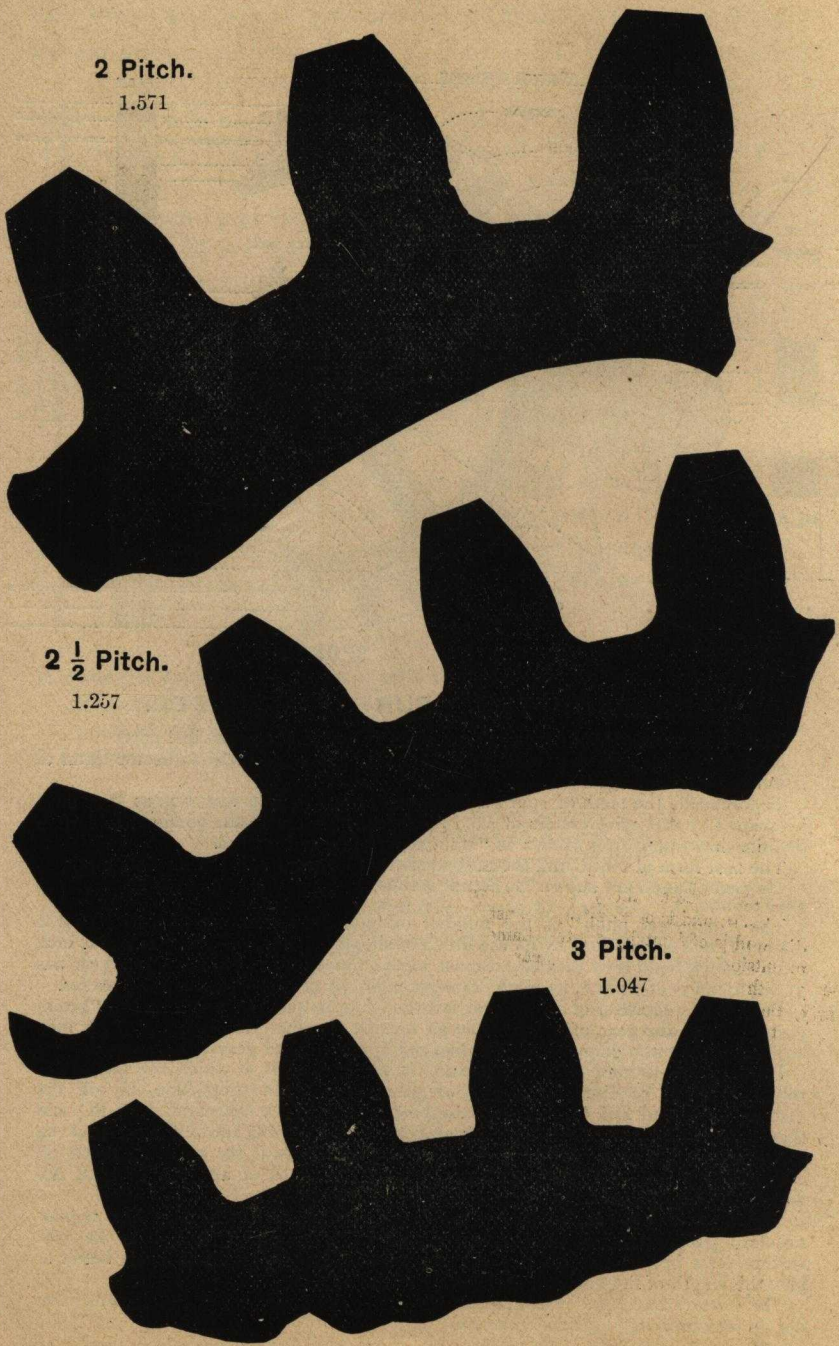
The "diametral pitch" is the number of teeth in a gear per inch of its pitch diameter, and calculations by its use are very simple. Thus, if a gear has a four inch pitch diameter and is of 12 pitch, it must have 4 times 12, or 48 teeth. If a gear has 37 teeth and is of 8 pitch, its pitch diameter must be 37 divided by 8, or $4\frac{5}{8}$ inches.

The outside diameter of a spur gear is larger than its pitch diameter by two "pitch-parts"; thus, any gear of 7 pitch has an outside diameter two sevenths of an inch larger than its pitch diameter. This does not apply to bevel gears;

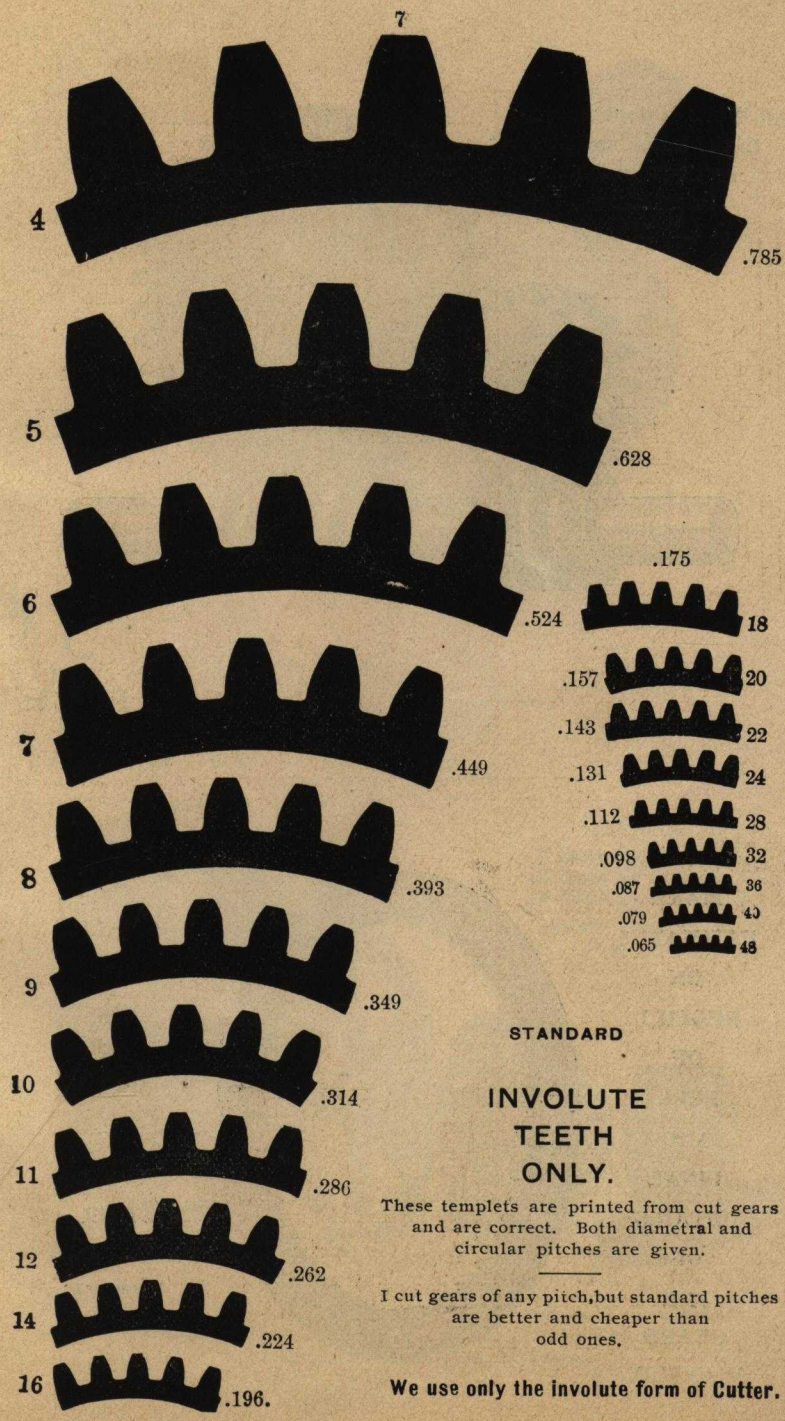
If the center distance AC is given, and the pitch point B, at which the pitch lines roll together, is required for a pair of gears of a given proportion, lay off the distances AD and DE in the given proportion and in any direction, draw EC, and then DB parallel to EC will fix the point B. The radii BC and AB must now be divisible by half a pitch-part of the pitch to be used; thus, if the gears are to be cut eight pitch, there must be a whole number of sixteenths of an inch in both AB and BC.

Customers should carefully remember that the pitch of a gear must be a regular standard pitch. They should also remember that the length of the hub is the part that projects beyond the rim, and not the apparent length, and it is much better to give the length of the hole rather than that of the hub.

The word "diameter," when applied to any gear, means its pitch diameter, and not its measured or "outside" diameter.



We use only the Involute form of Cutter.



STANDARD

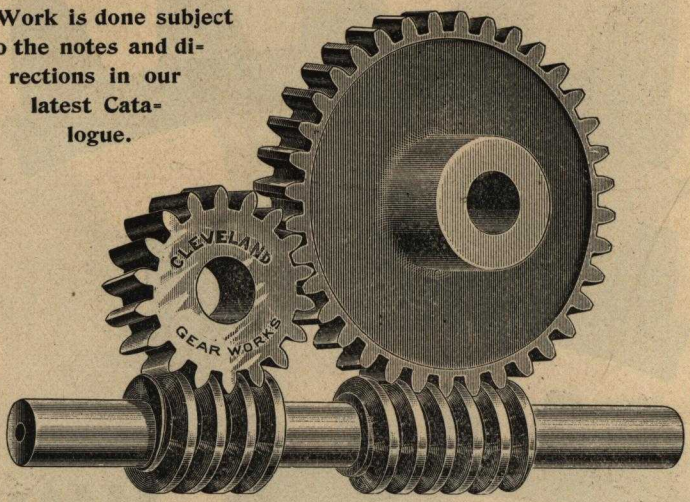
INVOLUTE TEETH ONLY.

These templets are printed from cut gears and are correct. Both diametral and circular pitches are given.

I cut gears of any pitch, but standard pitches are better and cheaper than odd ones.

We use only the involute form of Cutter.

All Work is done subject to the notes and directions in our latest Catalogue.

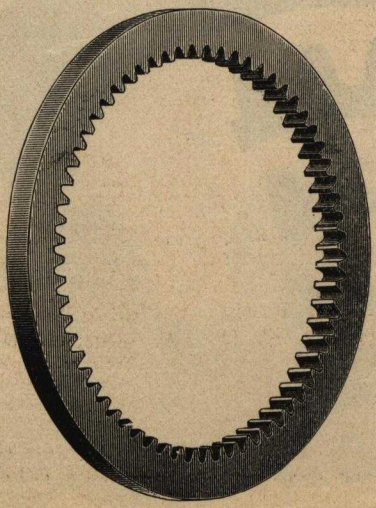


JOB

GEAR WHEELS A

OF EVERY DESC

WE MAKE ESTIMATES ON RECEIPT OF FULL AND FINAL DETAILS OF THE GEARS WANTED.



LARGE OR SMALL.

—

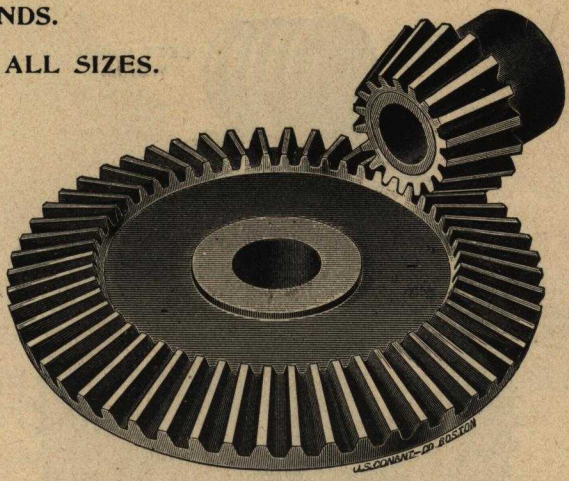
ONE OR MANY.

—

IRON, STEEL, BRASS, BRONZE. RAWHIDE, FIBRE.

ALL KINDS.

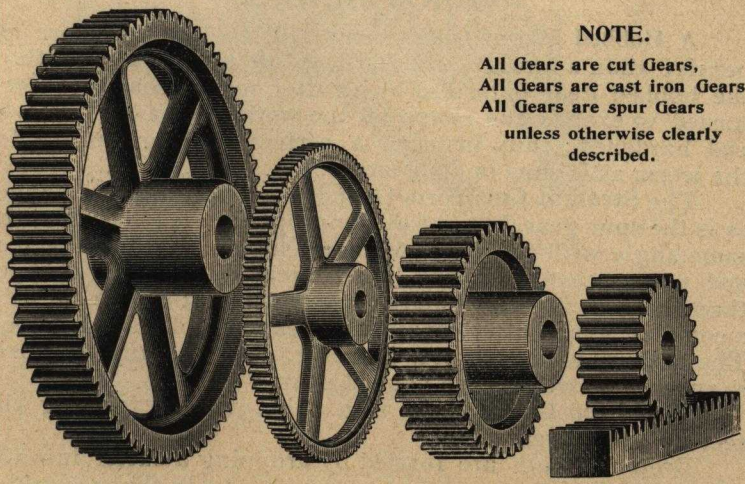
ALL SIZES.



BING

ND GEAR CUTTING

IPTION TO ORDER.

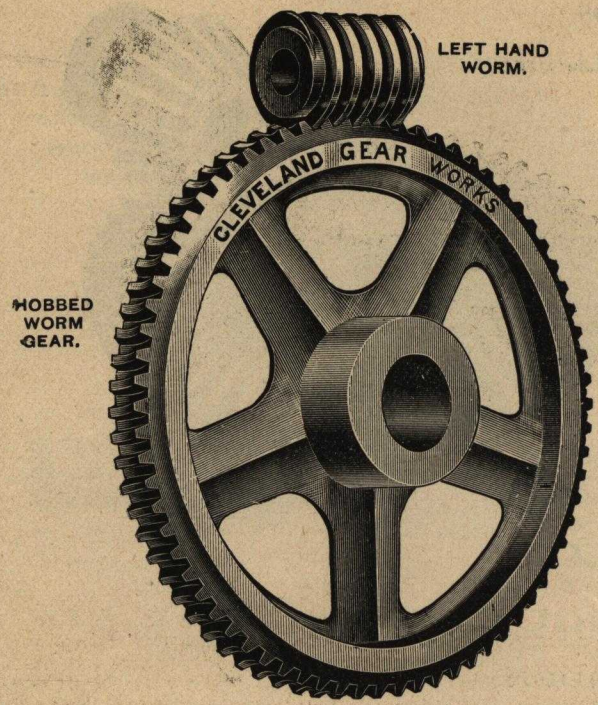


SPOKED. WEBBED. PLAIN

NOTE.

All Gears are cut Gears,
All Gears are cast iron Gears,
All Gears are spur Gears
unless otherwise clearly described.

A few gears made to special order will invariably cost much more than very similar list gears. A few gears made to order with cast teeth will cost more than cut gears.



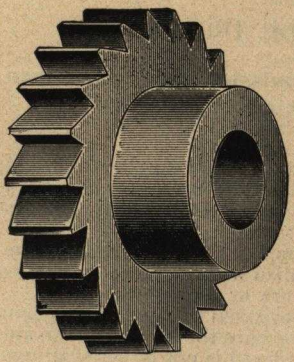
WORM GEARS.

A **Hobbed** Worm Gear is superior to, though more expensive than a straight cut, or drop cut gear. The tooth of the hobbed gear is formed by a cutter made from tool steel, turned to exactly the shape of the worm, serrated, relieved and hardened; thus insuring a perfect bearing surface for the worm as it runs in its gear.

The **Straight Cut** Worm Gear is made in the same manner as is the spur gear, but cut at the proper angle (that is, at the same angle with the worm teeth.) The face is straight across and not concave, as in the hobbed gear. It is often cheaper than the gear described above, inasmuch as it can be cut with a common gear cutter, saving the expense of a special tool. The bearing is not perfect, however, but for many purposes it answers as well as the hobbed gear.

The **Drop Cut** method is a third way of forming the teeth of worm gears.

Drop cut teeth are formed by dropping a cutter into the concave face of the gear, so as to make a tooth that resembles the hobbed tooth. The drop cut tooth is not as perfect as the hobbed tooth, nor as good as the straight cut, but when the gear is large it is a fair substitute.



RIGHT HAND
RATCHET.

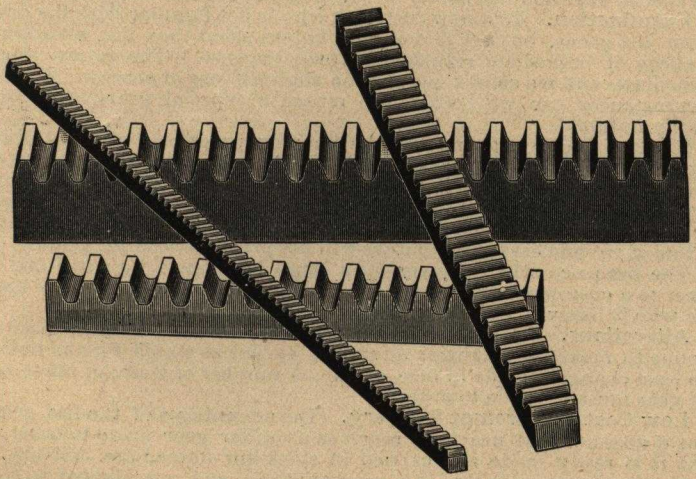
We make Ratchets to order only.

OUR RATCHETS

Are cut with a 60° Angular Cutter.

Any size made to order.

List sizes are without hubs, and therefore both **Right** and **Left** hand.



RACKS.

We make racks of any size to order, and have certain definite sizes in stock as per stock lists.

Racks made from drawn steel bars, or from brass rods, are not straight, but must be straightened by the purchaser when fastened into place.

A first-class rack can be made only from a bar planed to size, and even then there is likely to be a slight spring owing to the removal of the metal from one side of the bar.

A rack is always cut on the broad side of the bar unless otherwise ordered.

DESCRIPTION OF READY MADE IRON GEARS.

We have no agents and never give commission to a middle-man, but sell direct to the consumer at net prices at one profit.

The stock iron gears are of two kinds; cut, and cast.

Iron Cut Gears. These are first-class goods finished on rims and ends of hubs. The teeth are cut, and they are suitable for nice machine work. We guarantee them as well made and as true as any ready made gear that can be bought.

Iron Cast Gears. These are good cast gears, but they are rough as compared with cut gears, and not suitable for finished work. They are as good as cut gears for certain purposes, for rough work or slow motions.

Special Holes. When the size of hole is not given in the order we send the list hole, but at a small extra charge we will bore the hole larger to suit customer when so desired, provided the size ordered is not larger than one-and-a-half times that of the list hole. Cast gears have no holes unless ordered. The diameter of the hub of a cut gear is about twice that of the list hole. That of the hub of a cast gear is given by the list. Customers must not blame us if they order a hole so large that the hub is left weak. It must be borne in mind that a gear with a hub of specially large diameter is a special gear and not nearly as cheap as the regular list gear.

Examination. To a new customer who is not familiar with the quality of our list goods, but not to one who knows what they are, we allow the privilege of immediate return at his own expense. The return must be immediate and we cannot permit the slightest use or service. Under no circumstances can we permit the return of special gears, as they are wholly unsalable.

Prices. We have abandoned the common practice of a fixed list and a variable discount, and instead have adopted the method of definite net prices, On receipt of a definite list of gears wanted, giving the list numbers of the gears, we will promptly return a definite "net price" at which we will sell that whole lot within one month. We will send separate prices on lots of cut and cast gears, but we will not price the separate gears of a lot.

The net price will be lower for a large lot than for a small one, and lower to a customer who sends cash or is known to pay promptly than to one who is likely to defer payment.

Alterations. As the list gears are ready made we must positively decline to make the slightest alteration except as stated for the hole. If the least change is made in face, or hub, or number of teeth, or other detail, the gear must be made to order.

Low Cost and Prompt Delivery. The advantages of the list gear are that it does not cost nearly as much as a similar gear made to order, and that it is ready made and carried in stock for immediate delivery. Its single disadvantage is that it is unchangeable and not adapted to special requirements.

CUT STOCK LIST ¼ FACE, 24 PITCH.

See pages 6 and 7 for shape of Teeth.

No.	P. D.	Teeth.	Hole.	Style.	PRICE.
1812	½	12	9-32	Plain.	
1814	7-12	14	"	"	
1815	⅝	15	"	"	
1816	⅔	16	5-16	"	
1818	¾	18	"	"	
1820	5-6	20	"	"	

(Continued on next page.)

Net prices on above quoted at request.

CUT STOCK LIST ¼ FACE, 24 PITCH.—Continued.

No.	P. D.	Teeth.	Hole.	Style.	Price.
1822	⅞	21	5-16	Plain.	
1824	1	24	"	Webbed.	
1827	1⅛	27	"	"	
1830	1¼	30	⅜	"	
1832	1⅓	32	"	"	
1833	1⅜	33	"	"	
1836	1½	36	"	"	
1837	1⅝	39	"	"	
1838	1⅔	40	"	"	
1839	1¾	42	7-16	"	
1840	1⅞	45	"	"	
1841	2	48	"	"	
1842	2¼	54	"	"	
1843	2½	60	½	"	
1844	2¾	66	"	"	
1845	3	72	"	Spoked.	
1847	3½	84	"	"	
1849	4	96	"	"	
1851	5	120	⅝	"	
1853	6	144	"	"	
1899	Rack, Steel, ¼" face, 3-16" thick, 1" to 12" long,				

CUT STOCK LIST ⅜ FACE, 20 PITCH.

No.	P. D.	Teeth.	Hole.	Style.	PRICE.
1912	6-10	12	5-16	Plain.	
1914	7-10	14	"	"	
1915	¾	15	"	"	
1916	8-10	16	"	"	
1918	9-10	18	"	"	
1920	1	20	"	"	
1922	1 1-10	22	"	"	
1925	1¼	25	⅜	"	
1926	1 3-10	26	"	"	
1928	1 4-10	28	"	"	
1930	1½	30	"	"	
1932	1 6-10	32	"	"	
1935	1¾	35	7-16	"	
1936	1 8-10	36	"	"	
1940	2	40	"	Webbed.	
1941	2¼	45	"	"	
1942	2½	50	½	"	
1943	2¾	55	"	"	
1944	3	60	"	Spoked.	
1946	3½	70	"	"	
1948	4	80	"	"	

(Continued on next page.)

Net prices for above quoted at request.

Cut Stock List 3/8 Face, 20 Pitch.—(Continued.)

No.	P. D.	Teeth.	Hole.	Style.	Price.
1950	5	100	5/8	**Spoked.**	
1952	6	120	"	"	
1954	7	140	"	"	
1956	8	160	3/4	"	
1999	Rack, Steel, 3/8" face, 9-32" thick, 1" to 12" long,				

Cut Stock List 1/2 Face, 16 Pitch.

See pages 6 and 7 for shape of Teeth.

No.	P. D.	Teeth.	Hole.	Style.	PRICE.
2012	3/4	12	5-16	Plain.	
2013	13-16	13	"	"	
2014	7/8	14	"	"	
2015	15-16	15	"	"	
2016	1	16	"	"	
2018	1 1/8	18	"	"	
2020	1 1/4	20	3/8	"	
2022	1 3/8	22	"	"	
2024	1 1/2	24	"	"	
2026	1 5/8	26	"	"	
2028	1 3/4	28	7-16	"	
2030	1 7/8	30	"	"	
2032	2	32	"	Webbed.	
2034	2 1/4	36	"	"	
2036	2 1/2	40	1/2	"	
2038	2 3/4	44	"	"	
2040	3	48	"	"	
2042	3 1/2	56	"	"	
2044	4	64	"	Spoked.	
2046	5	80	5/8	"	
2048	6	96	"	"	
2050	7	112	"	"	
2052	8	128	3/4	"	
2054	9	144	"	"	
2056	10	160	7/8	"	
2058	11	176	"	"	
2060	12	192	"	"	
2099	Rack, Steel, 1/2" face, 3/8" thick, 1" to 18" long,				

Net prices for above quoted at request.

Cut Stock List ¾ Face, 12 Pitch.

See pages 6 and 7 for shape of Teeth.

No.	P. D.	Teeth.	Hole.	Style.	PRICE.
2212	1	12	⅜	Plain.	
2215	1¼	15	"	"	
2218	1½	18	7-16	"	
2221	1¾	21	"	"	
2224	2	24	½	"	
2230	2½	30	"	"	
2233	3	36	½	Webbed.	
2235	3½	42	"	"	
2237	4	48	⅝	"	
2241	5	60	"	"	
2244	6	72	¾	Spoked.	
2246	7	84	"	"	
2247	8	96	⅞	"	
2249	10	120	"	"	
2251	12	144	"	"	
2299	Rack, Steel, ¾" face, 9-16" thick, 1" to 24" long,				

Stock List 1 Face, 12 Pitch.

See pages 6 and 7 for shape of Teeth.

No.	P. D.	Teeth.	Hole.	Style.	PRICE.
2312	1	12	7-16	Plain.	
2315	1¼	15	"	"	
2318	1½	18	½	"	
2321	1¾	21	"	"	
2324	2	24	"	"	
2327	2¼	27	"	"	
2330	2½	30	⅝	"	
2333	2¾	33	"	"	
2336	3	36	"	"	
2338	3½	42	"	Webbed.	
2340	4	48	¾	"	
2344	5	60	"	"	
2348	6	72	"	Spoked.	
2349	7	84	"	"	
2350	8	96	⅞	"	
2352	10	120	"	"	
2354	12	144	1	"	
2356	14	168	"	"	
2357	16	192	"	"	
2399	*Rack, Cast Iron, 1" face, ¾" thick, 1" to 18" long,*				

Net prices for above quoted at request.

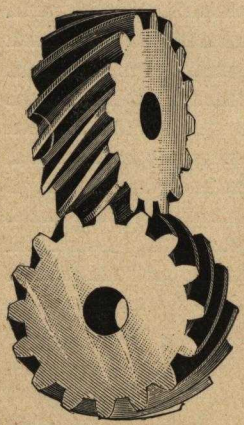
STOCK LIST 1½ FACE, 8 PITCH.

See pages 6 and 7 for shape of Teeth.

No.	P. D.	Teeth.	Hole.	Style.	PRICE.
2512	1½	12	½	Plain.	
2516	2	16	⅝	"	
2520	2½	20	"	"	
2524	3	24	¾	"	
2528	3½	28	"	"	
2532	4	32	⅞	"	
2538	5	40	"	Webbed.	
2540	6	48	⅞	**Webbed.**	
2542	7	56	"	"	
2544	8	64	1	"	
2547	10	80	"	Spoked.	
2549	12	96	1¼	"	
2550	14	112	"	"	
2551	16	128	"	"	
2552	18	144	"	"	
2553	20	160		"	
2599	Rack, Cast Iron, 1½" face, 1" thick, 1" to 24" long,				

Net prices for above quoted at request.

We cut spirals to run at a ratio of 2 to 1 The pitch diameters of driver and driven being the same. The gear running the faster is always the driver.



Left-Hand Spiral Gears.

Speed ratio 1 to 1. Angles 45°.

Spiral gears are useful to diminish speed, but not to increase speed.

SPIRAL GEARS.

We have special machinery of our own design for cutting spiral gears, and are prepared to do such work promptly and at moderate cost. As on other work, we will quote prices on receipt of full and final specifications. We do not carry these in stock, as experience has shown that any one size of hub or hole which we might decide upon to list as standard, would not meet the requirements of our customers. Spiral gearing is figured differently from any other kind of gear. So, unless you are thoroughly familiar with them it will be best to let us furnish you the figures for turning, if you propose sending us the gear-blanks to be cut.

Spiral gears may be made to run at any reasonable ratio by varying the angles and number of teeth. The longer angle must always be the driver. In case both gears are cut at an angle of 45°, then either gear may be the driver, and the speed of driver and driven bears the same ratio the one to the other as their pitch diameters.

FINISHED IRON CUT BEVEL GEARS.

STOCK LIST.

(See preceding description.)

Ready made and kept in stock, and cannot be altered in any particular. Bevel gears of different pairs will not run together.

No.	P. D.	Teeth.	Face.	Holes.	PRICE.
4007	½ Miter.	16	⅛	3-16	
4008	¾ "	18	5-32	¼	
4009	⅞ "	18	3-16	5-16	
4010	1 "	20	¼	⅜	
4011	1¼ "	20	5-16	7-16	
4012	1½ "	22	⅜	7-16	
4013	1¾ "	22	7-16	½	
4014	2 "	24	7-16	½	
4015	2¼ "	27	½	9-16	
4016	2½ "	30	9-16	⅝	
4018	3 "	30	¾	¾	
4019	3½ "	30	⅞	¾	
4020	4 "	32	1	⅞	
4022	5 "	36	1¼	⅞	
4023	6 "	36	1⅜	1	
4051	2 x 1⅓	30 x 20	⅜	½ x ⅜	
4053	3 x 2	36 x 24	⅝	¾ x ½	
4055	6 x 4	42 x 28	1	1 x ⅞	
4070	2 x 1	36 x 18	¼	7-16 x ⅜	
4071	2½ x 1¼	36 x 18	⅜	9-16 x ⅜	
4072	3 x 1½	36 x 18	7-16	¾ x 7-16	
4074	4 x 2	40 x 20	¾	¾ x ½	
4076	5 x 2½	44 x 22	1	⅞ x ⅝	
4077	6 x 3	44 x 22	1⅛	1 x ¾	
4110	2½ x 1	45 x 18	5-16	⅝ x ⅜	
4112	5 x 2	50 x 20	¾	⅞ x ½	
4125	3 x 1	48 x 16	⅜	¾ x ⅜	
4127	4½ x 1½	48 x 16	⅝	⅞ x 7-16	
4129	6 x 2	54 x 18	1	1 x ½	
4140	4 x 1	64 x 16	7-16	¾ x ⅜	
4141	6 x 1½	64 x 16	¾	1 x 7-16	

Net prices for above quoted at request.

SEND FOR **Grant's Gear Book,** PRICE $1.00, Post-paid.

A Practical and Theoretical Treatise on the Teeth of Gears.

CAST STOCK LIST ½ FACE, 12 PITCH.

Rough iron spur gears, with cast teeth.
Ready made and kept in stock, and cannot be altered in any particular.

No.	P. D.	Teeth.	Diam. Hub.	Style.	PRICE.
1050	1	12	No Hub.	Plain.	
1051	1¼	15	"	"	
1052	1½	18	"	"	
1053	1¾	21	"	"	
1054	2	24	1¼	Webbed.	
1055	2¼	27	"	"	
1056	2½	30	"	"	
1057	2¾	33	"	"	
1058	3	36	1½	"	
1059	3½	42	"	"	
1060	4	48	"	"	
1061	4½	54	"	"	
1062	5	60	"	"	
1063	5½	66	"	Spoked.	
1064	6	72	"	"	
1065	6½	78	1¾	"	
1066	7	84	"	"	
1067	7½	90	"	"	
1068	8	96	"	"	
1069	8½	102	"	"	
1070	9	108	"	"	
1071	9½	114	"	"	
1072	10	120	"	"	
1073	10½	126	"	"	
1074	11	132	"	"	
1075	11½	138	"	"	
1076	12	144	"	"	
1098	Rack, ½" face, 7-16" thick, 24" long,				

Net prices for above quoted at request.

CAST STOCK LIST 1 FACE, 8 PITCH.

Rough iron spur gears, with cast gears. See preceding description.
Ready made and kept in stock, and cannot be altered in any particular.

No.	P. D.	Teeth.	Diam. Hub.	Style.	PRICE.
1020	1½	12	No Hub.	Plain.	
1021	1¾	14	"	"	
1022	2	16	"	"	
1023	2½	20	"	"	
1024	3	24	1½	Webbed.	

Continued on next page.

CAST STOCK LIST 1 FACE, 8 PITCH.

(Continued.)

No.	P. D.	TEETH.	DIAM. HUB	STYLE.	PRICE.
1025	3½	28	1½	Webbed.	
1026	4	32	"	"	
1027	4½	36	"	"	
1028	5	40	1¾	"	
1029	5½	44	"	"	
1030	6	48	"	"	
1031	7	56	"	"	
1032	8	64	"	Spoked.	
1033	9	72	"	"	
1034	10	80	"	"	
1035	11	88	"	"	
1036	12	96	2	"	
1037	14	112	"	"	
1038	16	128	2¼	"	
1039	18	144	2½	"	
1040	20	160	2¾	"	
1099	Rack, 1" face, ⅝" thick, 24" long,				

Net prices for above quoted at request.

CAST STOCK LIST 1½ FACE, 6 PITCH.

Rough iron spur gears, with cast teeth.
Ready made and kept in stock, and cannot be altered in any particular.

No.	P. D.	Teeth.	Diam. Hub.	Style.	PRICE.
1210	2	12	No Hub.	Plain.	
1211	2 1-6	13	"	"	
1212	2⅓	14	"	"	
1213	2½	15	"	"	
1214	2⅔	16	"	"	
1215	2 5-6	17	"	"	
1216	3	18	1½	Webbed.	
1217	3⅓	20	"	"	
1218	3½	21	1¾	"	
1219	3⅔	22	"	"	
1220	4	24	"	"	
1221	4½	27	"	"	
1222	5	30	2¼	"	
1224	6	36	"	"	
1226	7	42	2½	"	
1228	8	48	"	"	
1230	9	54	"	"	
1232	10	60	"	Spoked.	

Continued on next page.

CAST STOCK LIST 1½ FACE, 6 PITCH.

Rough iron spur gears with cast teeth [Continued.]
Ready made and kept in stock, and cannot be altered in any particular.

No.	P. D.	TEETH.	DIAM. HUB	STYLE.	PRICE.
1234	11	66	2½	Spoked.	
1236	12	72	"	"	
1238	14	84	2¾	"	
1240	16	96	"	"	
1242	18	108	"	"	
1244	20	120	"	"	
1299	Rack, 1½" face, 1" thick, 30" long,				

Net price for above quoted at request.

CAST STOCK LIST 2 FACE, 4 PITCH.

Rough iron spur gears with cast teeth.
Ready made and kept in stock, and cannot be altered in any particular.

No.	P. D.	Teeth.	Diam. Hub.	Style.	PRICE.
1310	3	12	No Hub.	Plain.	
1311	3¼	13	"	"	
1312	3½	14	"	"	
1313	3¾	15	"	"	
1314	4	16	"	"	
1316	4½	18	"	"	
1318	5	20	2¼	Webbed.	
1320	6	24	"	"	
1322	7	28	2½	"	
1324	8	32	2¾	"	
1326	9	36	"	"	
1328	10	40	3	"	
1329	11	44	3¼	Spoked.	
1330	12	48	3½	"	
1332	14	56	"	"	
1334	16	64	"	"	
1336	18	72	"	"	
1338	20	80	3¾	"	
1339	22	88	"	"	
1340	24	96	"	"	
1341	26	104	4	"	
1342	28	112	"	"	
1343	30	120	4¼	"	
1344	32	128	"	"	
1345	34	136	"	"	
1346	36	144	4½	"	
1399	Rack, 2" face, 1½" thick, 36" long,				

Net prices on above quoted at request.

CAST STOCK LIST.

MITER AND BEVEL GEARS WITH CAST TEETH.

Rough iron gears, with cast teeth.

Ready made and kept in stock, and cannot be altered in any particular.

No.	P. D.	Teeth.	Face.	Hub.	PRICE PER PAIR.
1100	1 Miter.	12	¼	¾	
1101	1¼ "	15	5-16	⅞	
1102	1½ "	15	½	1	
1103	1¾ "	16	½	1¼	
1104	2 "	20	⅝	1¼	
1105	2¼ "	22	½	1⅜	
1106	2½ "	25	⅝	1⅝	
1107	3 "	24	¾	1⅞	
1108	3½ "	29	⅞	1⅞	
1109	4 "	32	1	2	
1110	5 "	40	1	2¼	
1112	6 "	48	1⅛	2⅜	
1120	3 x 2	30 x 20	¾	1½ x 1⅛	
1123	5 x 3	50 x 30	¾	1¾ x 2	
1130	2 x 1	24 x 12	⅜	1⅛ x ⅝	
1131	2½ x 1¼	30 x 15	½	1 x ¾	
1132	3 x 1½	48 x 24	½	1⅛ x 1	
1133	3½ x 1¾	42 x 21	¾	1⅝ x 1	
1134	4 x 2	30 x 15	¾	1⅞ x 1¼	
1135	5 x 2½	40 x 20	⅞	1⅞ x 1½	
1136	6 x 3	48 x 24	1	2¼ x 1⅝	
1137	8 x 4	64 x 32	1¼	2⅝ x 2¼	
1138	10 x 5	50 x 25	1⅜	3 x 2¾	
1144	3 x 1	36 x 12	½	1¼ x ¾	
1145	3¾ x 1¼	45 x 15	⅝	1⅝ x 1	
1146	4½ x 1½	54 x 18	¾	1¼ x 1	
1147	6 x 2	72 x 24	¾	1⅝ x 1¼	
1148	9 x 3	72 x 24	1¼	2¾ x 2⅛	
1155	4 x 1	48 x 12	11-16	1¾ x ¾	
1156	6 x 1½	72 x 18	⅞	1⅞ x 1¼	
1157	8 x 2	64 x 16	1¼	1⅞ x 1½	
1160	5 x 1	60 x 12	½	1⅝ x ¾	
1164	6 x 1	72 x 12	⅝	1¾ x ¾	

Net prices on above quoted at request.

HEAVY CAST LIST GEARS TO ORDER.

When the cast gear wanted agrees exactly with the following list as to face, number of teeth and style, we can make to order and will quote price on receipt of particulars. We can generally make hub and core hole to suit the customer, but the list dimensions are unchangeable. The patterns are strong and the spokes are flat. We bore holes and make key ways when so directed, but we cannot warrant a fit to a shaft or a key that we do not have in our hands to work to.

Designate gear wanted by letter and diameter, thus: A 12, or N 18 x 6.

SPUR GEARS OF 3 INCH FACE AND 3 PITCH.

P. D.	Teeth.
Plain.	
A 3⅓	10
A 3⅔	11
A 4	12
A 4⅓	13
A 4⅔	14
Webbed.	
A 5	15
A 5⅓	16
A 5⅔	17
A 6	18
A 6⅓	19
A 6⅔	20
A 7	21
A 8	24
A 9	27
A 10	30
A 11	33
A 12	36
Spoked.	
A 13⅓	40
A 15	45
A 16	48
A 17⅓	52
A 18⅔	56
A 20	60
A 22	66
A 24	72
A 26⅔	80
A 29⅓	88
A 32	96
A 36	108
A 40	120

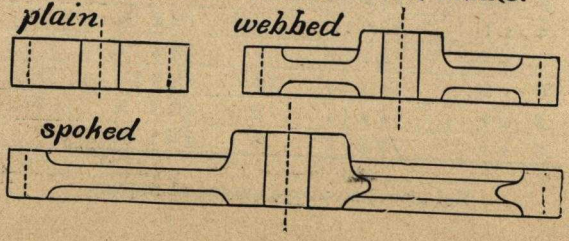
SPUR GEARS OF 4 INCH FACE AND 2 PITCH.

P. D.	Teeth.
Plain.	
B 5	10
B 5½	11
B 6	12
B 6½	13
Webbed.	
B 7	14
B 7½	15
B 8	16
B 8½	17
B 9	18
B 9½	19
B 10	20
B 11	22
B 12	24
B 13	26
B 14	28
B 15	30
B 16	32
Spoked.	
B 18	36
B 20	40
B 22	44
B 24	48
B 26	52
B 28	56
B 30	60
B 33	66
B 36	72
B 40	80
B 44	88
B 48	96
B 54	108
B 60	120

MITER AND BEVEL GEARS.

P. D.	Teeth.	Face.
Miter Gears.		
M 8	32	2
M 10	38	2½
M 12	44	3
M 16	50	4
M 20	56	5
M 24	62	5½
Bevel Gears.		
N 8 x 4	32 x 16	2
N 10 x 5	36 x 18	2½
N 12 x 6	40 x 20	3
N 18 x 9	44 x 22	4
N 12 x 4	48 x 16	3
N 18 x 6	63 x 21	4
N 16 x 4	64 x 16	4
N 20 x 5	60 x 15	4½

THE THREE STYLES OF SPUR GEARS.



INTERNAL.

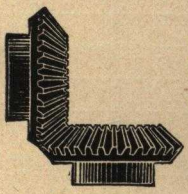
LISTS OF READY MADE BRASS GEARS.

These are finished Brass Gears that are ready made and kept in stock for immediate delivery at fixed list prices.

Prices include postage, on brass gears only.

We have no brass list gears not here advertised, and the list gears cannot be altered in any particular.

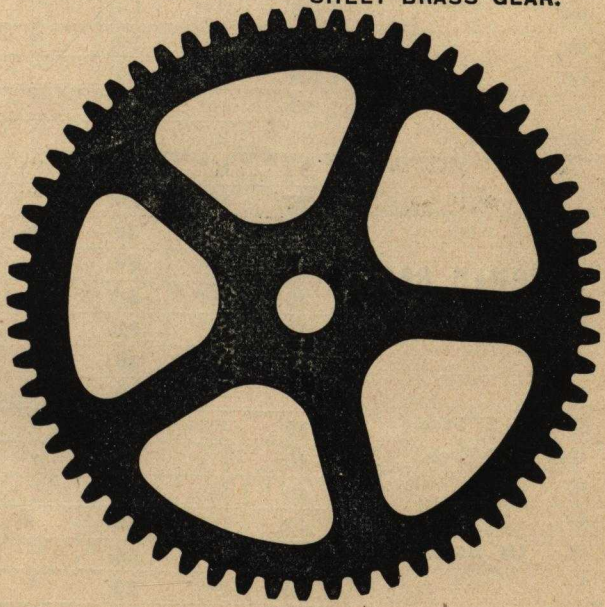
BEVEL.



MITER.

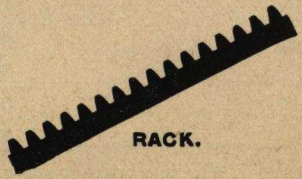
PINION WIRE.

SHEET BRASS GEAR.



BRASS GEARS TO ORDER.

Brass gears made to order at prices that will be quoted on receipt of full and final description.



RACK.

LIGHT BRASS SPUR GEARS.

48 PITCH.

THIN BRASS SPUR GEARS.

1-32″ Face, 48 Pitch.

Made of Sheet Brass.
Large Holes.
No Hubs.

1½″ and larger are spoked.

IN STOCK.

In stock and cannot be altered.

No.	P. D.	Teeth.	Hole.	Price.
10	½	24	1-8	.15
11	⅔	32	3-16	.20
12	¾	36	3-16	.20
13	1	48	3-16	.20
14	1½	72	1-4	.25
15	2	96	5-16	.30
16	2½	120	5-16	.40
17	3	144	5-16	.50
18	4	192	5-16	.60

FINISHED BRASS SPUR GEARS.

1-8″ Face.
48 Pitch.

IN STOCK.

No.	P. D.	Teeth.	Hole.	Style.	Price.
25	5-24	10	3-32	Plain.	.10
26	11-48	11	"	"	.10
27	¼	12	⅛	"	.10
28	7-24	14	"	"	.10
29	5-16	15	"	"	.10
30	⅓	16	"	"	.10
31	⅜	18	"	"	.10
32	5-12	20	"	"	.10
33	11-24	22	3-16	"	.10
34	½	24	"	"	.10
35	13-24	26	"	"	.12
36	⅔	32	"	"	.12
37	¾	36	"	"	.12
38	5-6	40	"	"	.14
39	22-24	44	"	"	.16
40	1	48	¼	Web.	.20
41	1⅛	54	"	"	.25
42	1¼	60	"	"	.30
43	1⅜	66	"	"	.35
44	1½	72	"	"	.40
45	1¾	84	"	"	.45
46	2	96	"	"	.50
47	2½	120	5-16	S. P.	.75
48	3	144	"	"	1.00
49	4	192	"	"	1.25
50	5	240	"	"	1.50
51	6	288	"	"	1.75

We quote prices on gears of any special size, or pitch or face, or style not listed in our catalogue.

LIGHT BRASS SPUR GEARS.

32 PITCH

In stock and cannot be altered.

THIN BRASS SPUR GEARS.

1-16″ Face.

32 Pitch.

Made of Sheet Brass.

Large Holes.

No Hubs.

1½″ and larger are spoked.

IN STOCK.

No.	P. D.	Teeth.	Hole.	Price.
110	½	16	3-16	.10
111	9-16	18	"	.10
112	⅝	20	"	.12
113	¾	24	"	.12
114	⅞	28	"	.12
115	1	32	"	.15
116	1¼	40	¼	.20
117	1½	48	"	.25
118	2	64	5-16	.30
119	2½	80	"	.35
120	3	96	"	.40
121	3½	112	"	.45
122	4	128	⅜	.50
123	4½	144	"	.55
124	5	160	"	.60
125	6	192	"	.70

FINISHED BRASS SPUR GEARS.

3-16″ Face.

32 Pitch.

IN STOCK.

No.	P. D.	Teeth.	Hole.	Style.	Price.
130	3-16	6	1-16	Plain.	.10
131	7-32	7	3-32	"	.10
132	¼	8	⅛	"	.10
133	9-32	9	"	"	.10
134	5-16	10	"	"	.10
135	11-32	11	"	"	.10
136	3-8	12	"	"	.10
137	13-32	13	"	"	.10
138	7-16	14	"	"	.10
139	15-32	15	"	"	.10
140	½	16	3-16	"	.10
141	9-16	18	"	"	.12
142	⅝	20	"	"	.12
143	11-16	22	"	"	.15
144	¾	24	"	"	.15
145	13-16	26	"	"	.15
146	⅞	28	"	"	.20
147	15-16	30	"	"	.20
148	1	32	¼	"	.20

[CONTINUED ON NEXT PAGE.]

We quote prices on gears of any special size. or pitch or face, or style not listed in our catalogue.

LIGHT BRASS SPUR GEARS.

32 PITCH. In stock and cannot be altered.

[CONTINUED FROM LAST PAGE.]

No.	P. D.	Teeth.	Hole.	Style.	Price.
149	1⅛	36	¼	Plain.	.25
150	1¼	40	"	Web.	.25
151	1⅜	44	"	"	.25
152	1½	48	"	"	.30
153	1⅝	52	"	"	.30
154	1¾	56	5-16	"	.30
155	2	64	"	"	.35
156	2¼	72	"	Spokes.	.40
157	2½	80	"	"	.50
158	3	96	"	"	.70
159	3½	112	"	"	.90
160	4	128	"	"	1.00

METAL PATTERNS.

We can furnish metal patterns of any desired style or size of gear, and shall be pleased to quote prices on receipt of full detail.

We have in stock patterns for the cast gears that we list in our catalogue.

An order for any other size of cast gear requires the making of a special pattern.

Where many gears are wanted, and the requirements are such that the **cast gear** will answer, it pays to have metal patterns made.

Where but a few gears are wanted, it pays rather to get the **cut gear,** even though they are to be used where so good a gear is not necessary, because the cost of making the pattern will make the few cast gears as expensive as the cut gear (if not more so), and, of course, it will be **inferior** to the cut gear.

Brass patterns for small gears, especially where the pitch is fine, are preferable, but iron patterns answer very well for larger gears and course pitches.

HEAVY BRASS SPUR GEARS.

24 PITCH.

In stock and cannot be altered.

FINISHED BRASS SPUR GEARS.

1-4″ Face.
24 Pitch.

IN STOCK.

No.	P. D.	Teeth.	Hole.	Style.	Price.
210	7-24	7	⅛	Plain.	.10
211	⅓	8	"	"	.10
212	⅜	9	"	"	.10
213	5-12	10	"	"	.10
214	11-24	11	"	"	.10
215	½	12	3-16	"	.10
216	13-24	13	"	"	.12
217	7-12	14	"	"	.12
218	⅝	15	"	"	.15
219	⅔	16	"	"	.15
220	¾	18	¼	"	.20
221	5-6	20	"	"	.20
222	⅞	21	"	"	.25
223	1	24	"	"	.25
224	1⅛	27	"	"	.30
225	1¼	30	"	Web.	.35
226	1⅓	32	"	"	.35
227	1⅜	33	"	"	.40
228	1½	36	"	"	.45
229	1⅝	39	"	"	.50
230	1⅔	40	"	"	.55
231	1¾	42	5-16	"	.55
232	2	48	"	"	.60
233	2¼	54	"	"	.65
234	2½	60	"	"	.70
235	2¾	66	"	"	.80
236	3	72	"	"	.90
237	3½	84	⅜	"	1.00
238	4	96	"	"	1.10

We quote prices on gears of any **Special** size, or pitch, or face, or style, not listed in catalogue.

BRASS PINION WIRE.

48 PITCH. **32 PITCH.** **24 PITCH.**

In stock and cannot be altered.

BRASS PINION WIRE.

48 Pitch.

In pieces 12″ long.
A piece 6″ long at one-half price plus 10c.
A piece 3″ long at one-quarter price plus 5c.

IN STOCK.

No.	Teeth.	Price.
75	8	.40
76	9	.40
77	10	.40
78	11	.50
79	12	.50
80	14	.50
81	15	.60
82	16	.60
83	18	.60
84	20	.70
85	22	.80
86	24	1.00

BRASS PINION WIRE

32 Pitch.

In pieces 12″ long.
A piece 6″ long at one-half price plus 10 cents.
A piece 3″ long at one-quarter price plus 5 cents.

IN STOCK.

No.	Teeth.	Price.	No.	Teeth.	Price
180	8	.50	186	15	.80
181	9	.60	187	16	.90
182	10	60	188	18	.90
183	11	.70	189	20	1.00
184	12	.70	190	22	1.10
185	14	.80	191	24	1.20

BRASS PINION WIRE.

24 Pitch.

In pieces 12″ long.
A piece 6″ long at half price plus 10 cents.
A piece 3″ long at quarter price plus 5 cents.

IN STOCK.

No.	Teeth.	Price.
260	8	.60
261	9	.70
262	10	.80
263	11	.90
264	12	1.00
265	14	1.10
266	15	1.10
267	16	1.15
268	18	1.20
269	20	1.40
270	22	1.60
271	24	2.00

BRASS BEVEL GEARS.

CARRIED IN STOCK AND CANNOT BE ALTERED. PRICES INCLUDE POSTAGE.

FINISHED BRASS MITER GEARS.

IN STOCK.

No.	P. D.	Teeth.	Pitch.	Hole.	Face.	Price per Pair.
310	5-16	15	48	1/8	3-32	.40
311	3/8	18	48	"	7-64	.45
312	1/2	16	32	3-16	1/8	.50
313	3/4	24	32	"	5-32	.60
314	1	24	24	1/4	7-32	.80

Bevel or miter gears of different pairs will not run together.

Shafts are always at right angles.

FINISHED BRASS BEVEL GEARS.

IN STOCK.

No.	P. D.	Teeth.	Holes.	Face.	Price per Pair.
320	3/4 x 1/4	36 x 12	3-16 x 1/8	3-32	.60
321	3/4 x 3/8	36 x 18	"	1/8	.60
322	1 x 1/4	48 x 12	"	"	.60
323	1 x 1/2	32 x 16	3-16 x 3-16	5-32	60
324	1 x 2/3	33 x 22	1/4 x 3-16	3-16	.80
325	1 x 3/4	32 x 24	"	"	.80
326	1 1/2 x 1/2	48 x 16	"	1/4	.80
327	1 1/2 x 3/4	36 x 18	1/4 x 3-16	"	.90
328	2 x 1/2	64 x 16	5-16 x 3-16	"	1.00
329	2 x 1	48 x 24	5-16 x 1/4	9-32	1.10
330	2 1/2 x 1/2	80 x 16	5-16 x 3-16	1/4	1.20

PRICES OF BRASS CROWN BEVEL GEARS.

IN STOCK.

Any Crown Gear will run fairly well with any Spur Gear of same pitch and small diameter, and, for very light work, is a good substitute for the Bevel Gear.

	Pitch Diam.	3/4	1	1 1/2	2	2 1/2	3
Pitch	48 p. 1-32 f.	.30	.40	.60	1.00	1.50	2.00
and	32 p. 3-64 f.	.25	.30	.40	.60	.90	1.20
face.	24 p. 5-64 f.		.30	.40	.50	.80	1.00

PRICES OF BRASS RATCHETS.

IN STOCK. None have hubs.

Diameter.		1/2	3/4	1	1 1/4	1 1/2	2
Pitch and face.	48 p. 1-8 f. 32 p. 3-16 f. 24 p. 1-4 f	.20	.25	.35	.40	.50	.70

BRASS INTERNAL GEARS.

48 PITCH. **32 PITCH.** **24 PITCH.**

In stock and cannot be altered.

BRASS INTERNAL GEARS.
1-8″ Face. 48 Pitch.

Plain rings without spokes or plates.
O. D. is the outside diameter.

IN STOCK.

No.	P. D.	Teeth.	O. D.	Price.
60	1	48	1½	1.25
61	1¼	60	1¾	1.25
62	1½	72	2	1.25
63	1¾	84	2½	1.40
64	2	96	2¾	1.50
65	2½	120	3¼	1.60
66	3	144	3¾	1.80
67	4	192	4¾	2.00

We will make to order any other size than these listed and quote prices at request.

BRASS INTERNAL GEARS.
3-16 Face. 32 Pitch.

Plain rings without spokes or plates.
O. D. is outside diameter.

IN STOCK.

No.	P. D.	Teeth.	O. D.	Price.
167	1	32	1½	1.25
168	1¼	40	1¾	1.25
169	1½	48	2	1.25
170	1¾	56	2½	1.50
171	2	64	2¾	1.50
172	2½	80	3¼	1.60
173	3	96	3¾	1.70
174	4	128	4¾	2.00

We will make to order any other size than these listed and quote prices at request.

BRASS INTERNAL GEARS.
1-4″ Face.
24 Pitch.

Plain rings without spokes or plates.
O. D. is outside diam.

IN STOCK.

No.	P. D.	Teeth.	O. D.	Price.
245	1¼	30	2	1.60
246	1½	36	2¼	1.60
247	1¾	42	2½	1.70
248	2	48	2¾	1.70
249	2½	60	3¼	1.80

We will make to order any other size than these listed and quote prices at request.

BRASS RACK.

48 PITCH. **32 PITCH.** **24 PITCH.**

BRASS RACK.
48 Pitch.
1-8″ Face.

In Pieces 3, 6, or 12″ long.

IN STOCK.

No.	Size.	Length.	Price.
87	⅛ x ⅛	3	.15
88	⅛ x ⅛	6	.30
89	⅛ x ⅛	12	.60
90	⅛ x ¼	3	.18
91	⅛ x ¼	6	.36
92	⅛ x ¼	12	.72

Any size made to order and prices given at request.

BRASS RACK.
32 Pitch. 3-16 Face.

In pieces 3″, 6″, or 12″ long.

IN STOCK.

No.	Size.	Lgth.	Pr.	No.	Size.	Lgth.	Pr.
194	3-16 x 3-16	3	.15	197	3-16 x ⅜	3	.24
195	3-16 x 3-16	6	.30	198	3-16 x ⅜	6	.48
196	3-16 x 3-16	12	.60	199	3-16 x ⅜	12	.96

Any size made to order and prices given at request.

BRASS RACK.
24 Pitch.
1-4″ Face.

In pieces 3″, 6″, or 12″ long.

IN STOCK.

No.	Size.	Length.	Price.
280	¼ x ¼	3	.18
281	¼ x ¼	6	.36
282	¼ x ¼	12	.72
283	¼ x ½	3	.30
284	¼ x ½	6	.60
285	¼ x ½	12	1.20

Prices include postage on brass list gears.
Every order for a list gear must give the list number only.

ESTIMATES.

Special prices given on **Brass Gears** ordered in quantities whether they are listed in catalogue or not.

Estimates of cost furnished promptly on all classes of work.

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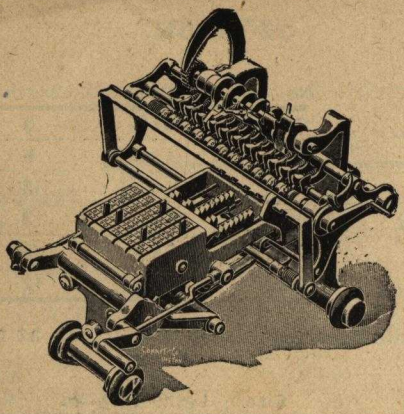

SAVES ERRORS
SAVES LABOR
SAVES TIME
SAVES HEALTH
SAVES MONEY

ADDS 5 FIGURES
PRODUCT 10 FIGURES
SIZE 10 X 10 X 10 INCHES
WEIGHT 10 POUNDS

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TOOL STEEL AND IT WILL NOT SPREAD AND FORM A "BURR" WHERE THE TOOL-POST SET SCREW HOLDS IT.

THE GRANT LATHE TOOL HOLDER.

SIZE OF HOLDER—
1 in. high.
9-16 in. wide.
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SIZE OF TOOL—
¼ in. square.

PRICE OF HOLDER—
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TOOLS EXTRA—
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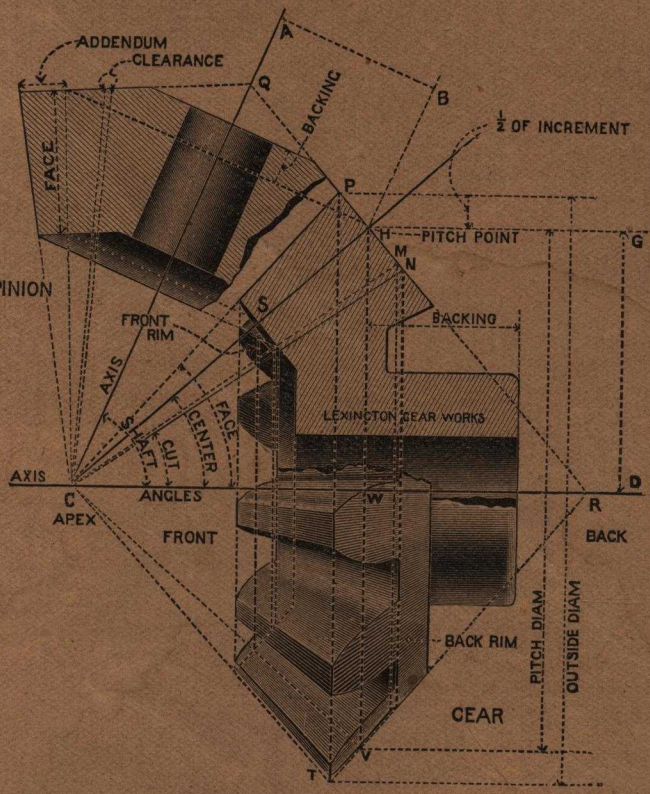


DRAWING THE BEVEL GEAR.

When the axes of a pair of gears meet at an angle they are called bevel gears. When the axes are at right angles and the gears are equal, they are called miter gears.

To draw a pair of bevel gear blanks, as in the figure, at any shaft angle, draw the given axes AC and DC, meeting at the apex C. Lay off the distances AB and DG equal to the given pitch radii of the gears. Draw BH and GH parallel to the axes, and from their intersection, the pitch point H, draw the center line HC to the apex. Lay off HS equal to the given face. Draw QHR at right angles to HC.

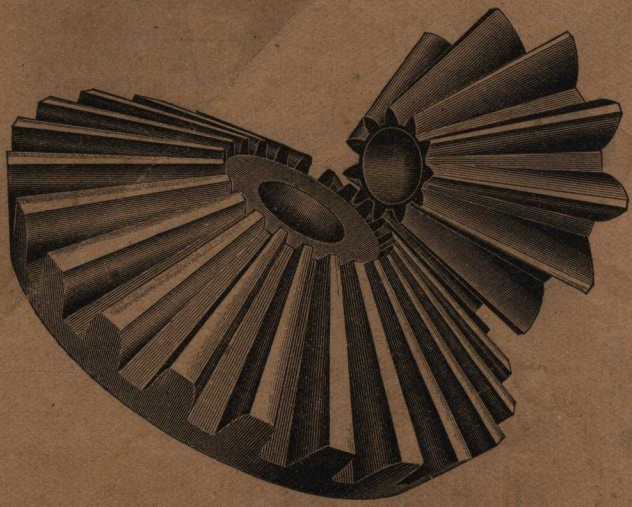
Lay off HP and HM each equal to the known addendum, and MN equal to the known clearance. Draw PC, MC and NC.

PCH = HCM is the increment angle, also called the addendum angle. PCD is the face angle, NCD is the cut angle.

The "backing" is the distance from the pitch line to the back end of the hub. The small ends of the teeth are at the "front," and the large ends at the "back" of the gear.

The working pitch diameter of the gear is the diameter HV. The "outside diameter" is the diameter PT, and it is to be observed that the "increment," or difference between the pitch and the outside diameters, is variable with the angle of the gear, not being the same for all gears of the same pitch, as with spur gears.

Notice that all lines on the teeth, tops, sides, and bottoms, meet at the apex C.



GRANT GEARS.

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